

AM V Breakout Group 1

Sortie-Class Missions to Mars

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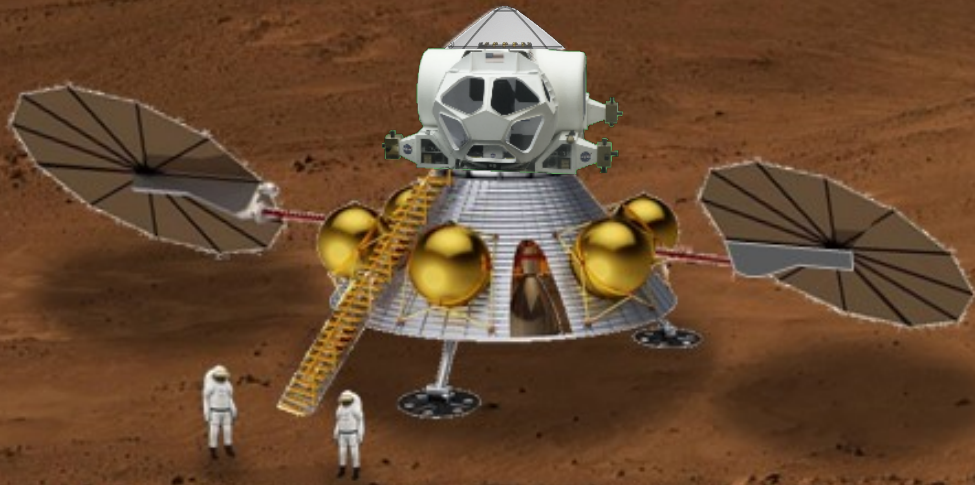
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Mars Short Surface Stay Mission

First Crew on Mars

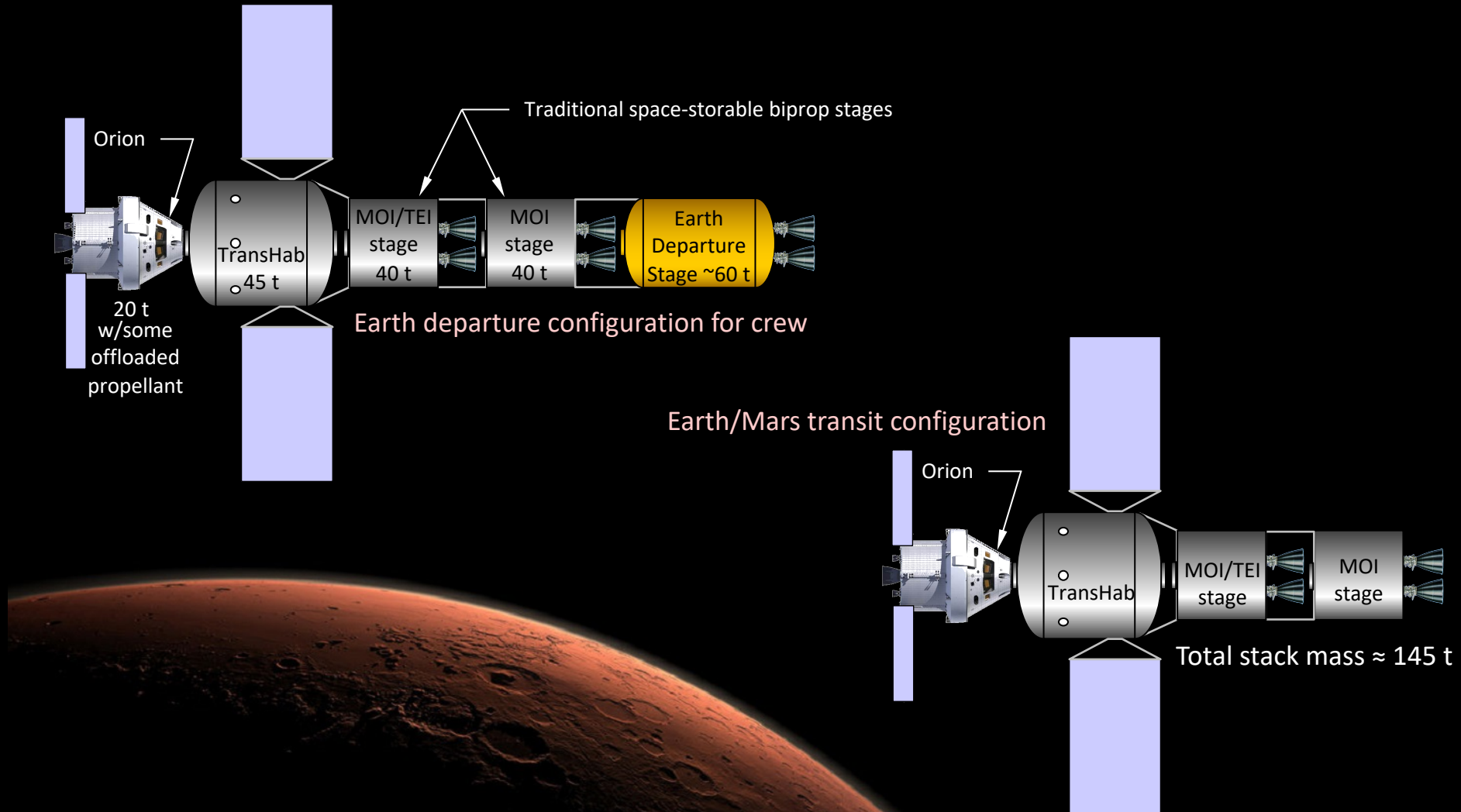
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- **Goal:** A sortie-class mission in the 2030s to kick off crewed exploration of Mars
- ~2 week surface mission
- Would be the pathfinder for a continuing series of crewed missions to Mars
- Would include a separate sky crane cargo lander with unpressurized rover and science equipment that would provide for crew surface transportation and could also be teleoperated from orbit.
- Would be significantly greater in scope than Apollo 17

Notional Mars Transit Vehicle Configuration for AM V Architecture 1 - All-Up Departure Stack

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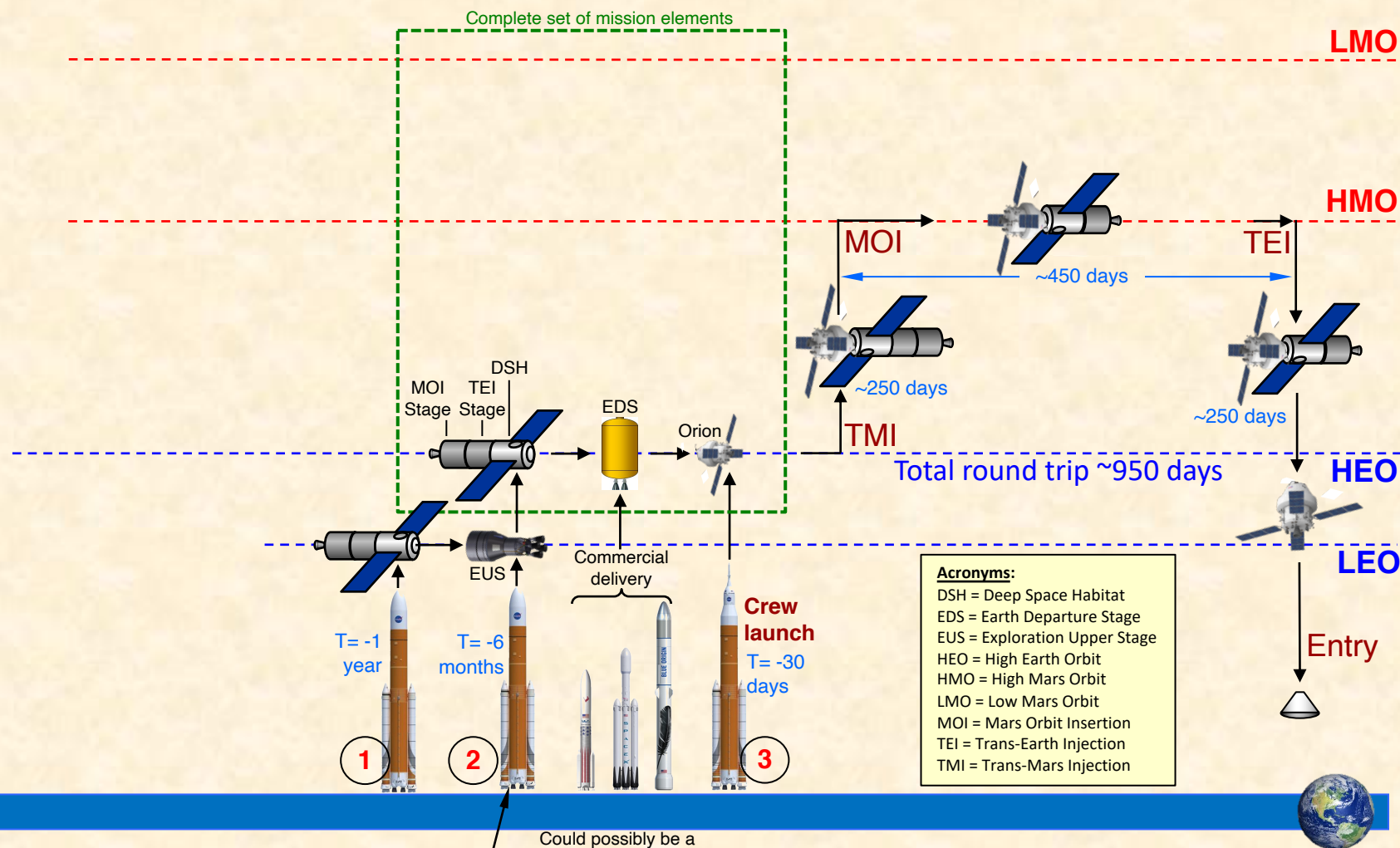


Mars Orbit Mission Concept

crew of 4; 3 SLS launches; ~4 commercial launches

AM V

Mars



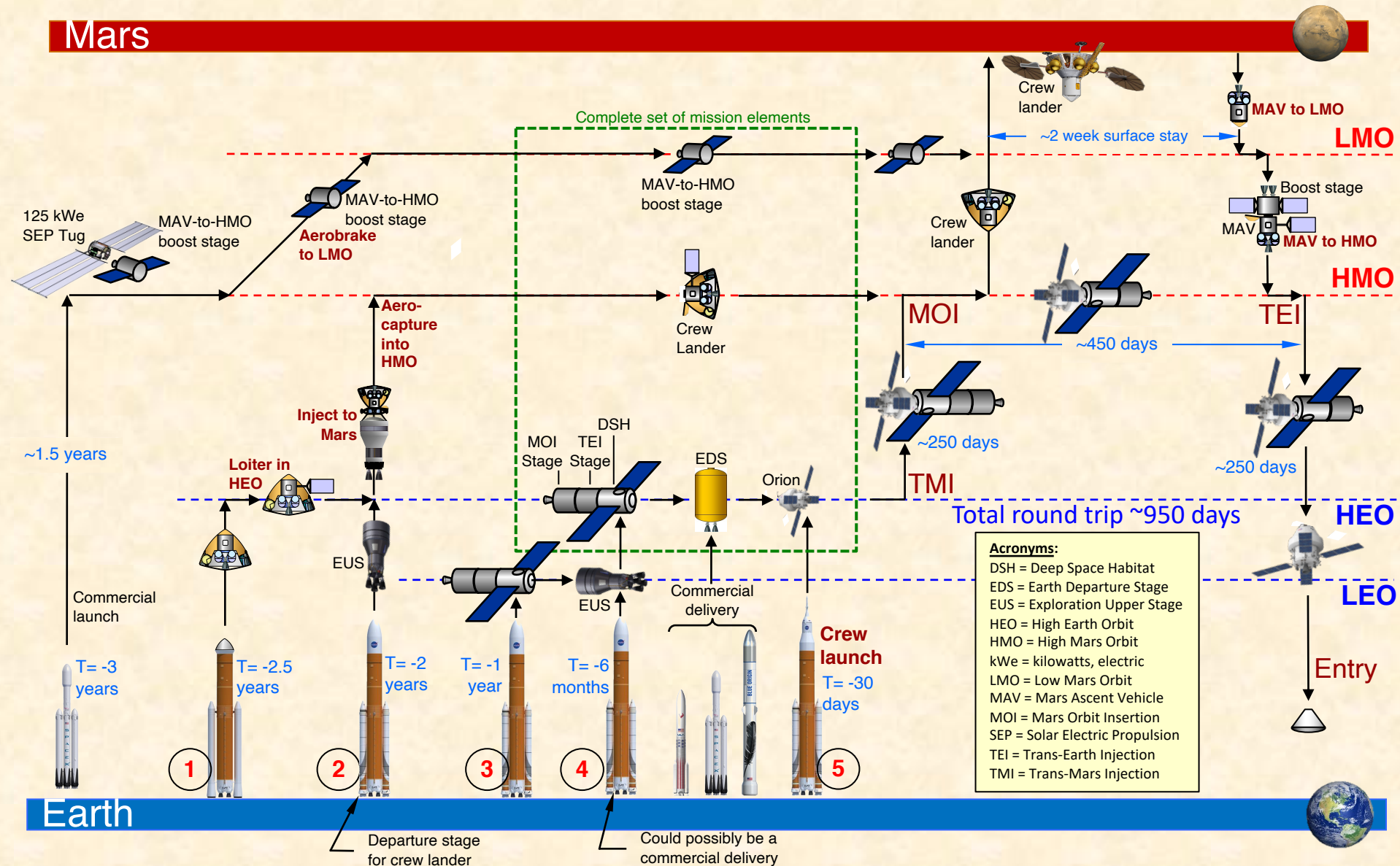
Earth



Could possibly be a commercial delivery
Pre-decisional. For discussion purposes only.

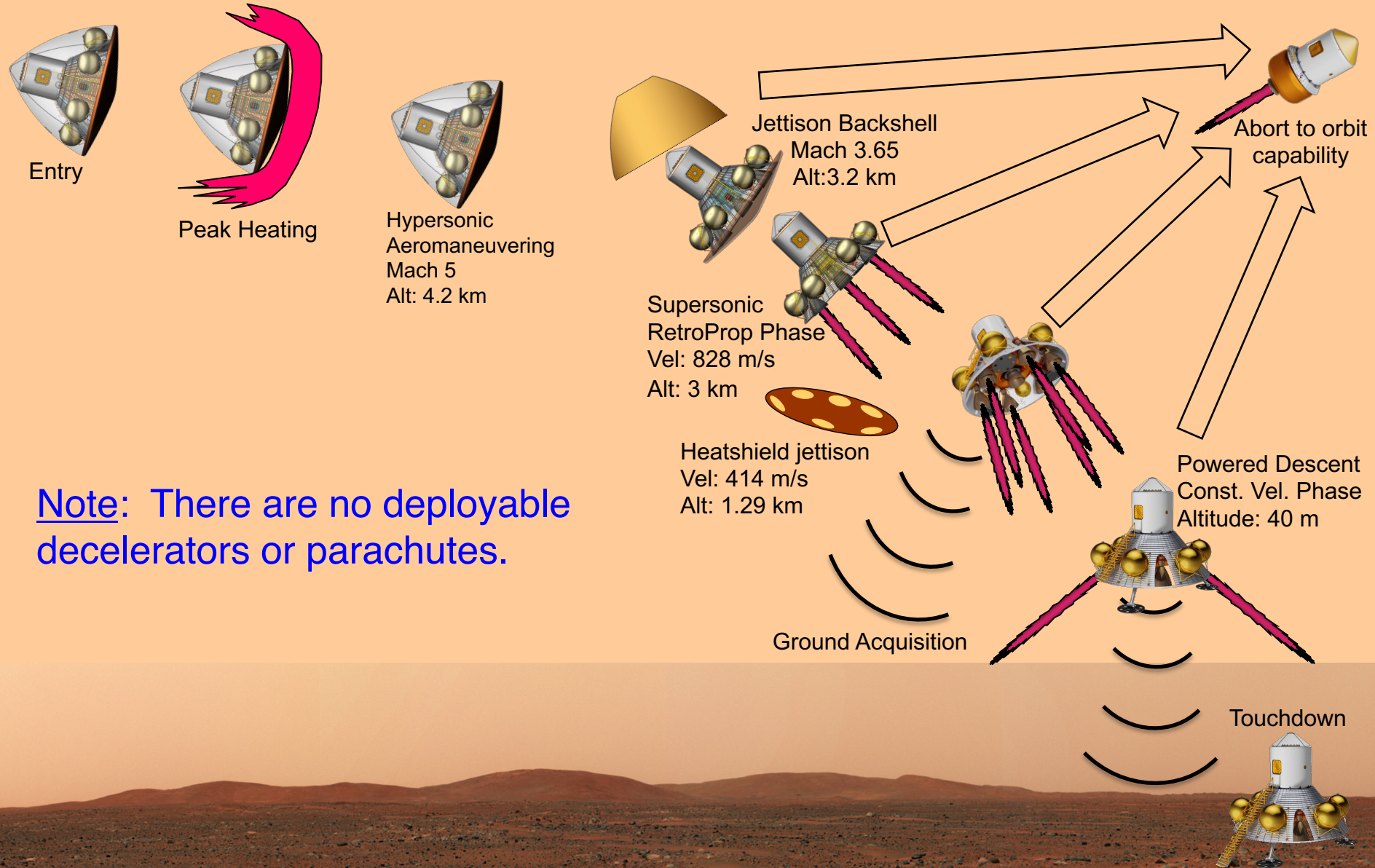
Two-Week Mars Surface Sortie Mission Concept

crew of 4; 5 SLS launches; ~5 commercial launches



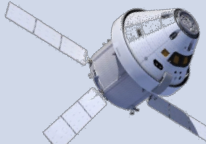

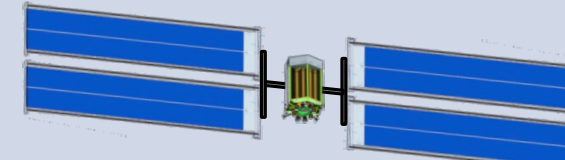
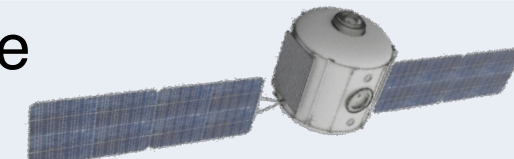
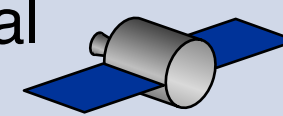
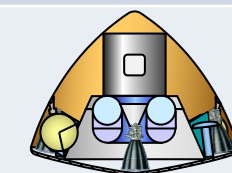
Entry, Descent, and Landing (EDL) Concept for Crewed Mars Lander

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Note: There are no deployable decelerators or parachutes.

Six Vehicles to Enable Crewed Missions to Mars

Vehicles	# Vehicles per Mission	Production Rate	
Orion 	1	1 every 4 years	In development
SLS 	5	1.25 per year	In development
SEP Tug ~125 kWe 	1	1 every 4 years	Studies are on contract
Deep Space Habitat 	1	1 every 4 years	Studies are on contract
In-Space Chemical Propulsion Stage 	4	1 per year	Could be an international contribution
Mars Lander 	1	1 every 4 years	Development would need to start soon

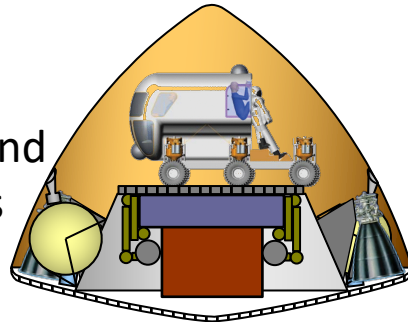
Notional Mars Mission Sequence

- Mars orbit-only mission in 2033
- Separate robotic sky crane mission would deliver 1 t unpressurized rover with science equipment
 - Could be controlled from Earth for site characterization
 - Could be teleoperated from Mars orbit
 - Would serve as unpressurized rover for the landing crew
- 1ST two-week landing sortie in 2037
- 2ND two-week landing sortie in 2041
- 3RD and following missions could include cargo landers, habitats, and/or pressurized rovers and other equipment
- Flight rate could potentially be increased to a new crew every Mars opportunity
- Program could expand to add more cargo landers, have longer stays, on-ramp new technologies, and build up a base

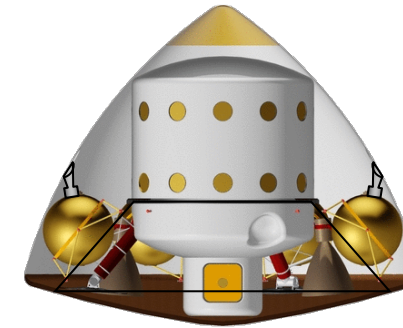
Long-Stay Surface Missions

- Would build on the short-stay architecture by adding a surface habitat, pressurized rover and science equipment
 - Cargo landers would carry the surface habitat, rover, etc.
 - Could build up infrastructure and on-ramp food production, ISRU, etc.

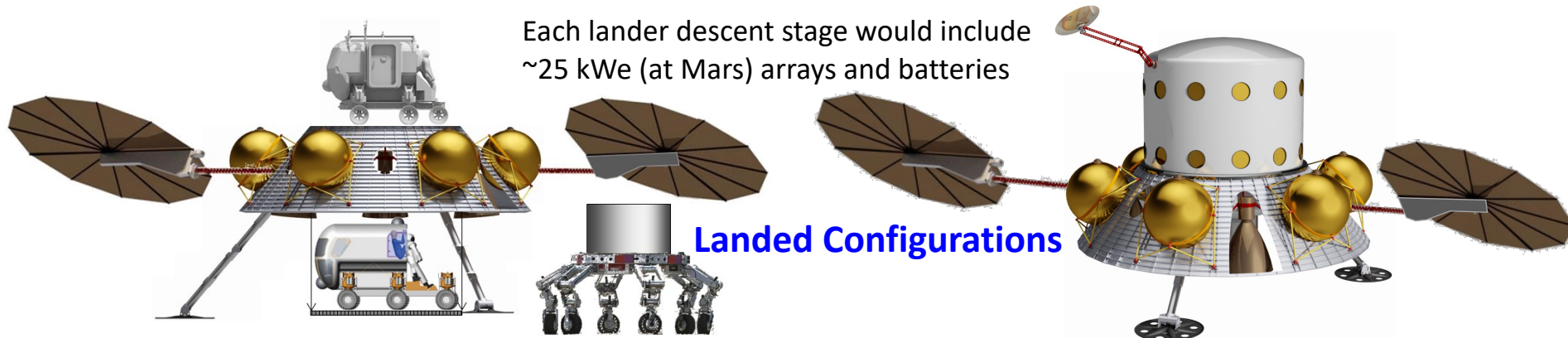
Cargo and logistics



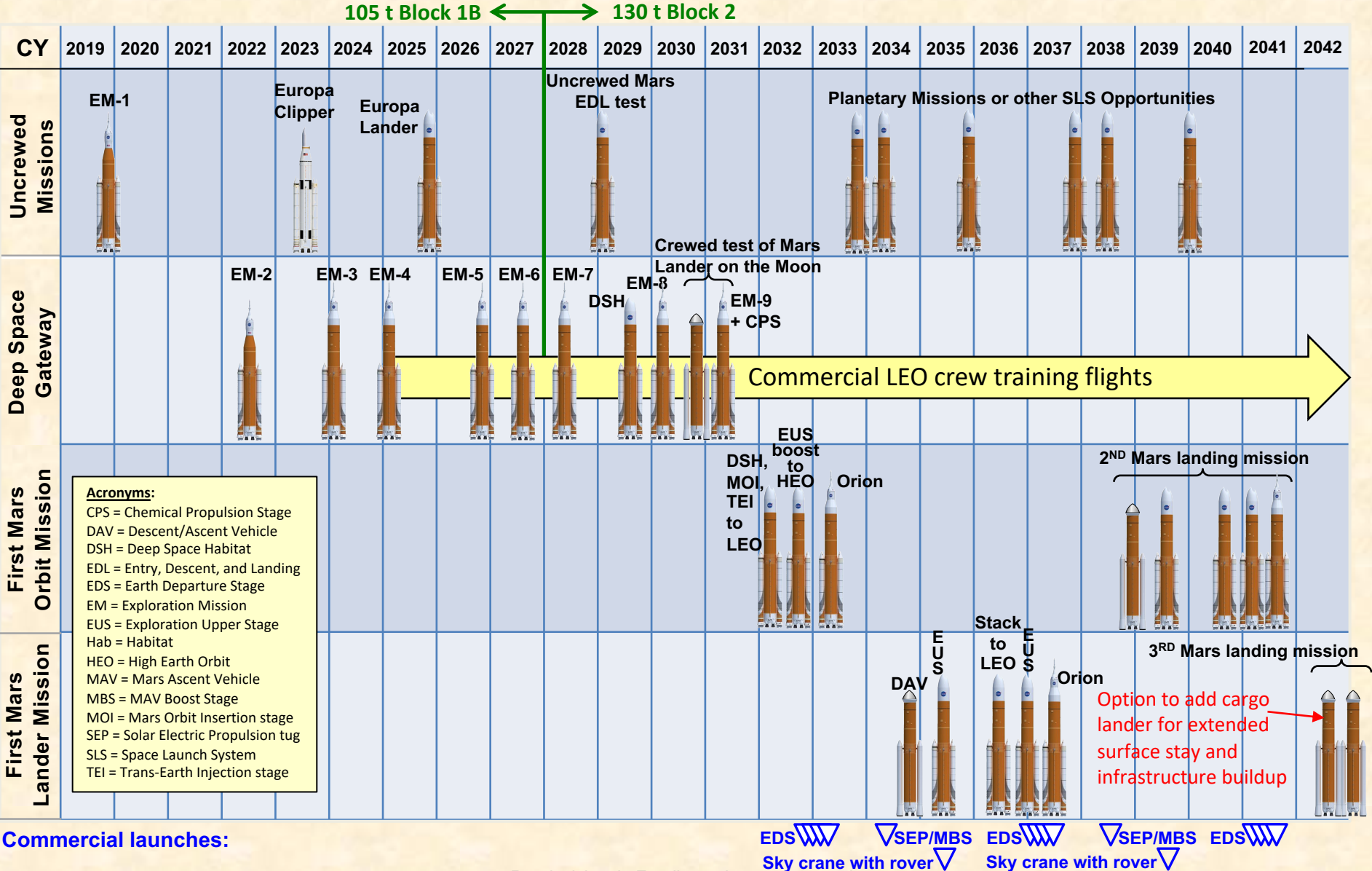
Entry Configurations



Surface habitat



Notional SLS Flight Scenario



AM V Group 1 Program Cost Estimate

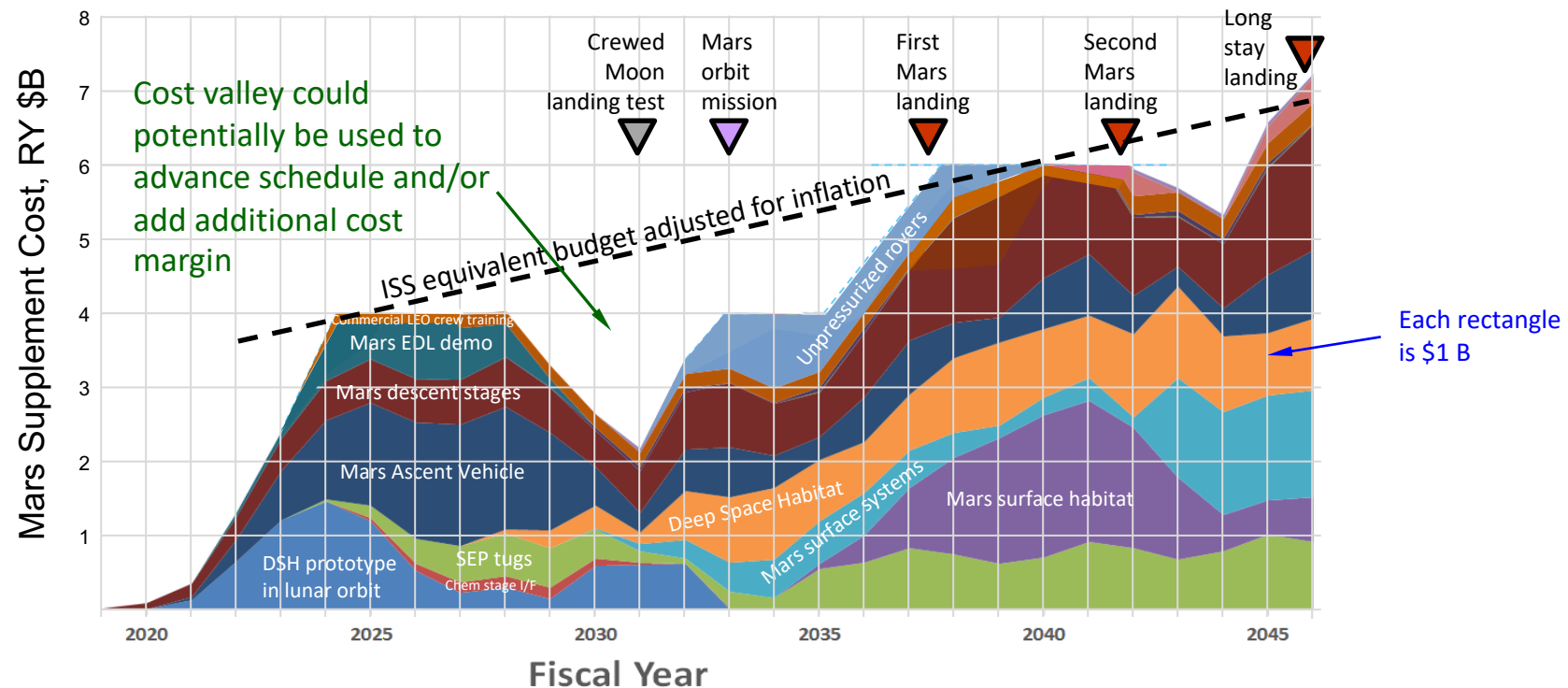
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Mars budget supplement only, in real year dollars (includes 2.6% inflation)

Assumes SLS, Orion, and Gateway funded as separate budget items

Assumes international partners provide in-space chemical propulsion stages

- Cost methodology developed by the Aerospace Corporation
- Same methodology as 2014 NRC “Pathways” and 2017 OIG report
- Results suggest a similar annual cost and total cost as ISS, over ~25 years, adjusted for inflation



The cost information contained in this document is of a budgetary and planning nature and is intended for informational purposes only. It does not constitute a commitment on the part of JPL and/or Caltech. Pre-decisional. For discussion purposes only.